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the traditional ski boots where Q_{loss} is defined as in equation [5] with the additional resistance of the phase change material layer.

In the Claims:

Please cancel claims 1-23 without prejudice or disclaimer.

Please add the following new claims.

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24. A garment for metabolic cooling and for insulation of a user in a cold ambient environment below a phase transition temperature of a thermal storage material, comprising:

a buffering thermal storage material capable of storing thermal energy as the latent heat of phase change located in the garment;

said thermal storage material comprising a phase change material having at least one actual phase transition temperature between 41.9 and 80.6 degrees Fahrenheit; and

said thermal storage material having a thermal mass at least equal to a difference between a minimum heat loss from the thermal storage material to the ambient environment at a temperature below the actual phase transition temperature of the phase change material and a maximum metabolic heat absorbed by the thermal storage material for at least one hour.

25. The garment of claim 24, wherein:

said thermal storage material comprises a mixture of at least two phase change materials having at least two different transition temperatures; or

said thermal storage material comprises at least two layers of phase change materials with different transition temperatures.

26. The garment of claim 24, wherein said phase change material undergoes a solid-solid transition or a solid-liquid transition.

27. The garment of claim 24, wherein said thermal storage material comprises a phase change material absorbed in particles of a superabsorbent material.

28. The garment of claim 24, wherein said phase change material is micro encapsulated.

29. The garment of claim 24, wherein said phase change material is encapsulated.

30. The garment of claim 24, wherein said phase change material is in pellets.

31. The garment of claim 24, wherein said phase change material is contained in a cellulose matrix.

32. The garment of claim 24, further comprising a thermal control layer located on a first side of said thermal storage material adapted to face a wearer and an insulative layer located on a second side of said thermal storage material adapted to face the ambient environment, said insulative layer being of greater insulative value than said thermal control layer.

33. The garment of claim 24, wherein a surface layer of the garment comprises a semipermeable membrane which is permeable to water vapor but impermeable to liquid water.

34. The garment of claim 24, wherein said garment comprises an article of clothing.

35. The garment of claim 34, wherein said article of clothing is selected from the group consisting of a shirt, a jacket, trousers, a blanket, a gaiter, a facial mask, a hat and an earmuff.

36. The garment of claim 34, wherein said article of clothing is in the form of a removable liner configured to be worn in combination with other clothing.

37. The garment of claim 34, wherein said article of clothing comprises a diver's wetsuit.

38. The garment of claim 34, wherein said thermal storage material is contained within closed internal spaces of the article of clothing or is incorporated into a fabric of the article of clothing.

39. The garment of claim 24, wherein said garment comprises an article of footwear.

40. The garment of claim 39, wherein said article of footwear comprises a ski boot.

41. The garment of claim 39, wherein said article of footwear comprises a shoe.

42. The garment of claim 39, wherein said article of footwear comprises a ski boot liner, a sock or a removable liner configured to be worn in combination with other footwear.

43. The garment of claim 39, wherein said phase change material is enclosed in internal spaces within said footwear.

44. The garment of claim 24, wherein said thermal storage material has a thermal mass at least equal to a difference between a heat loss from the thermal storage material to the ambient environment below the actual phase transition temperature of the thermal storage material and a metabolic heat absorbed by the thermal storage material for about four to about nine hours.

45. The garment of claim 24, wherein said phase change material comprises an organic material.

46. The garment of claim 24, wherein at least one said phase change material has an actual phase transition temperature in a range from 41.9 degrees Fahrenheit to 71.1 degrees Fahrenheit.

47. The garment of claim 24, wherein said thermal storage material has a thermal loading of phase change material from 1.34 BTU to 94.03 BTU per square foot of a surface area of the garment.


48. The garment of claim 47, wherein said thermal storage material has a thermal loading of phase change material from 10.3 BTU to 46.67 BTU per square foot of a surface area of the garment.

49. The garment of claim 47, wherein said thermal storage material has a thermal loading of phase change material from 1.34 BTU per square foot to 10.3 BTU per square foot of a surface area of the garment.

50. A garment for metabolic cooling and for insulation of a user in a cold ambient environment below a phase transition temperature of a thermal storage material, comprising:

a thermal capacitor comprising a buffering thermal storage material capable of storing thermal energy as the latent heat of phase change located in the garment;

said thermal storage material comprising a phase change material having at least one actual phase transition temperature between 41.9 and 80.6 degrees Fahrenheit;

 said thermal storage material having a thermal mass sufficient to partially decouple a heat transfer between the ambient environment and the thermal capacitor and a heat transfer of metabolic heat absorbed by the thermal capacitor; and

the thermal mass of the thermal storage material and the phase transition temperature of the phase change material are sufficient to maintain the phase change material in a partially solid and partially liquid state for at least one hour when the thermal capacitor is exposed to an ambient environment below the actual phase transition temperature of the phase change material from one side and to metabolic heat from another side.

51. The garment of claim 50, further comprising a thermal control layer located on a first side of said thermal storage material adapted to face a wearer and an insulative layer located on a second side of said thermal storage material adapted to face the ambient environment, said insulative layer being of greater insulative value than said thermal control layer.

52. The garment of claim 50, wherein said garment comprises an article of clothing.

53. The garment of claim 50, wherein said garment comprises an article of footwear.

54. The garment of claim 50, wherein at least one phase change material has an actual phase transition temperature in a range from 41.9 degrees Fahrenheit to 71.1 degrees Fahrenheit.

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55. The garment of claim 50, wherein said thermal storage material has a thermal loading of phase change material from 1.34 BTU to 94.03 BTU per square foot of a surface area of the garment.

56. The garment of claim 50, wherein the thermal mass of the thermal storage material and the phase transition temperature of the phase change material are sufficient to maintain the phase change material in the partially solid and partially liquid state for about four to about nine hours when the thermal capacitor is exposed to the ambient environment below the phase transition temperature of the phase change material from one side and to metabolic heat from another side.

57. The garment of claim 50, wherein heat transfer between the ambient environment and the thermal capacitor induces a liquid to solid transition in the phase change material while the heat transfer of metabolic heat induces a solid to liquid transition to maintain the phase change material in the partially solid and partially liquid state.

58. The garment of claim 50, wherein said phase change material comprises an organic material.

59. An article of footwear for metabolic cooling and for insulation of a user in a cold ambient environment below a phase transition temperature of a thermal storage material, comprising:

a buffering thermal storage material capable of storing thermal energy as a latent heat of phase change located in the article of footwear;

said thermal storage material comprising a phase change material having at least one actual phase transition temperature between 41.9 and 80.6 degrees Fahrenheit; and

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said thermal storage material having a thermal mass at least equal to a difference between a minimum heat loss from the thermal storage material to the ambient environment at a temperature below the actual phase transition temperature of the phase change material and a maximum metabolic heat absorbed by the thermal storage material for at least one hour.

60. The article of footwear of claim 59, wherein:

said thermal storage material has a thermal mass at least equal to a difference between a minimum heat loss from the thermal storage material to the ambient environment at a temperature below the actual phase transition temperature of the phase change material and a maximum metabolic heat absorbed by the thermal storage material for about four to about nine hours; and
said phase change material comprises an organic material.

61. A garment for metabolic cooling and for insulation of a user in a cold ambient environment below a phase transition temperature of a thermal storage material, comprising:

a buffering thermal storage material capable of storing thermal energy as the latent heat of phase change located in the garment;

said thermal storage material comprising a phase change material having at least one actual phase transition temperature between 41.9 and 80.6 degrees Fahrenheit; and

said thermal storage material has a thermal loading of phase change material from 1.34 BTU to 94.03 BTU per square foot of a surface area of the garment.

62. The garment of claim 61, wherein:

at least one phase change material has an actual phase transition temperature in a range from 41.9 degrees Fahrenheit to 71.1 degrees Fahrenheit; and

said thermal storage material has a thermal loading of phase change material from 10.3 BTU to 46.67 BTU per square foot of a surface area of the garment.

63. The garment of claim 61, wherein said thermal storage material has a thermal loading of phase change material from 1.34 BTU per square foot to 10.3 BTU per square foot of a surface area of the garment.

64. The garment of claim 61, wherein:

at least one phase change material has an actual phase transition temperature in a range from 41.9 degrees Fahrenheit to 71.1 degrees Fahrenheit; and

said thermal storage material has a thermal loading of phase change material from 1.34 BTU per square foot to 10.3 BTU per square foot of a surface area of the garment.

65. The garment of claim 61, wherein the thermal storage material comprises an aggregate of phase change material particles incorporated into a bonding material.

66. The garment of claim 61, wherein the thermal storage material comprises a dispersion of a phase change material in a sprayed on sheet of coating material.

67. The garment of claim 61, wherein the thermal storage material comprises a dispersion of a phase change material that was incorporated into a paste while in a liquid state during lamination.

68. The garment of claim 61, further comprising a wicking element located in the garment.

69. An article of bedding for metabolic cooling and for insulation of a user in an ambient environment, comprising:

a buffering thermal storage material capable of storing thermal energy as the latent heat of phase change located in the garment;

said thermal storage material comprising a phase change material having at least one actual phase transition temperature between 41.9 and 80.6 degrees Fahrenheit; and

said thermal storage material has a thermal loading of phase change material from 1.34 BTU to 94.03 BTU per square foot of a surface area of the garment.

70. The garment of claim 69, wherein:

at least one phase change material has an actual phase transition temperature in a range from 41.9 degrees Fahrenheit to 71.1 degrees Fahrenheit; and

said thermal storage material has a thermal loading of phase change material from 1.34 BTU to 10.3 BTU per square foot of a surface area of the garment.